

科目ナンバリング		U-LAS10 10024 SE55							
授業科目名 <英訳>	Quest for Mathematics II-E2 Quest for Mathematics II-E2			担当者所属 職名・氏名	数理解析研究所 講師 上田 福大				
群	自然科学科目群		分野(分類)	数学(基礎)		使用言語	英語		
旧群	B群	単位数	2単位	週コマ数	1コマ	授業形態	ゼミナール(対面授業科目)		
開講年度・ 開講期	2024・前期		曜時限	木4		配当学年	全回生	対象学生	全学向

[授業の概要・目的]

You might have heard of the following expression from Gauss (1777-1855): "Mathematics is the queen of sciences and number theory is the queen of mathematics. She often condescends to render service to astronomy and other natural sciences, but in all relations she is entitled to the first rank."

What is number theory? At the most basic level, it is the study of the properties of the integers $Z = \{\dots, -2, -1, 0, 1, 2, \dots\}$.

In this course, we will study certain topics in elementary number theory, including (but not limited to) divisibility, congruences, quadratic reciprocity, and theory of quadratic forms. Some abstract algebra will be introduced in class as a tool of number theory.

[到達目標]

The class is meant to help students of all disciplines improve their knowledges in number theory. Moreover, students will improve their communication skills in English via oral discussions and presentations.

[授業計画と内容]

Below is the contents and schedules of the course. Some of these topics may be assigned to the students for their presentations. The lectures and presentations, as well as their orders, may be modified, depending on students' backgrounds and understanding of the course materials. The instructor will provide corrections and comments on students' presentations.

(1) Introduction (Week 1)

-Some basics in set theory and logic, motivating examples and conjectures, remarks on the course materials.

(2) Divisibility (Weeks 2-4)

-The division algorithm, prime numbers;
-The fundamental theorem of arithmetic.

(3) Congruences (Weeks 5-8)

-Congruence relations;
-Fermat's theorem and Euler's generalization;
-The Chinese Remainder theorem, Hensel's lemma;

(4) Quadratic reciprocity (Weeks 9-12)

-Legendre symbols, the reciprocity law;
-Gaussian integers, two squares theorem.

(5) Quadratic forms (Week 13-14)

Quest for Mathematics II-E2(2)

Total : 14 classes, 1 Feedback session

【履修要件】

There are no formal prerequisites for the class. Some familiarity with mathematical proofs (e.g. as one sees in Calculus and Linear Algebra) will be helpful, but not required.

【成績評価の方法・観点】

The evaluation consists of three weighted parts:

- Discussion performance in class (20%).
- Presentation (60%): Each student reviews a mathematical topic assigned by the instructor.
- Report (20%): An essay on the topic of presentation.

【教科書】

A. Weil 『Number Theory for Beginners』 (Springer) ISBN:9781461299585 (E-book available at Kyoto U library.)

Ivan Niven, Herbert Zuckerman, and Hugh Montgomery 『An Introduction to the Theory of Numbers』 (Wiley) ISBN:9780471625469 (This book is available online.)

【参考書等】

(参考書)

J. S. Milne 『Algebraic Number Theory』 (This online lecture note may be helpful to the students who have studied modern algebra systematically.)

【授業外学修（予習・復習）等】

Along with preparation and review, students are encouraged to form study groups.

【その他（オフィスアワー等）】